

# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

REC'D 26 MAR 2004

WIPO PCT



Applicant's or agent's file reference TS 6346 PCT	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/PEA416)	
International application No. PCT/EP 03/01744	International filing date (day/month/year) 07.03.2003	Priority date (day/month/year) 08.03.2002
International Patent Classification (IPC) or both national classification and IPC E21B7/26, E21B7/26		
Applicant SHELL INTERNATIONALE RESEARCH MAATSCHAPP BV et al.		

- This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
- This REPORT consists of a total of 5 sheets, including this cover sheet.
  - ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 4 sheets.

- This report contains indications relating to the following items:

- I ☒ Basis of the opinion
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand  07.10.2003	Date of completion of this report  25.03.2004
Name and mailing address of the international preliminary examining authority:   European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer  Telephone No. +49 89 2399-  

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**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. **PCT/EP 03/01744**

**I. Basis of the report**

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

**Description, Pages**

2-12 as originally filed  
1, 1a received on 24.12.2003 with letter of 24.12.2003

**Claims, Numbers**

4 (part), 5-13, 18 (part), 19-23 as originally filed  
1-3, 4 (part), 14-17, 18 (part) received on 24.12.2003 with letter of 24.12.2003

**Drawings, Sheets**

1/2-2/2 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).  
☐ the language of publication of the international application (under Rule 48.3(b)).  
☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.  
☐ filed together with the international application in computer readable form.  
☐ furnished subsequently to this Authority in written form.  
☐ furnished subsequently to this Authority in computer readable form.  
☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.  
☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:  
☐ the claims, Nos.:  
☐ the drawings, sheets:

**INTERNATIONAL PRELIMINARY  
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International application No. **PCT/EP 03/01744**

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5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Yes: Claims	2,6-8,11-15,17,19-23
	No: Claims	1,3-5,9,10,16,18
Inventive step (IS)	Yes: Claims	11-13
	No: Claims	1-10,14-23
Industrial applicability (IA)	Yes: Claims	1-23
	No: Claims	

2. Citations and explanations

**see separate sheet**

Reference is made to the following documents:

- D1 = EP 0 395 167 A
- D2 = US 4 955 439 A
- D3 = US 4 856 600 A
- D4 = US 3 818 996
- D5 = US 2002/0000332 A1
- D6 = US 2001/0023614 A1

**V - Reasoned statement under Art. 35(2) PCT**

V-1 D1, which is considered as the closest prior art, describes a steerable soil penetration system, the system comprising:

- a steerable penetration head (11, col. 3, line 20) which is configured to penetrate the soil without the action of rotating cutters (col. 4, lines 19-21) and which is connected to an elongated flexible tubing (10, fig. 1) such that the orientation of the penetration head can be varied relative to the tubing (col. 3, line 20 and col. 4, lines 36-38); and

- means (col. 3, lines 32-35) for injecting the elongated flexible tubing (10) into the hole pierced by the penetration head (11) and for inducing the penetration head to pierce the head in a desired direction (col. 4, lines 37-39).

The subject-matter of claim 1 is therefore not new and the claim does not meet the corresponding requirement of Art. 33(2) PCT.

For completeness it is pointed out that the subject-matter of claim 1 is not new also in the light of D2, see col. 6, lines 4-9 for the steering mechanism; col. 6, lines 40-47 and col. 7, lines 7-9 for compacting the ground; col. 5, lines 39-41 and col. 12, line 66 - col. 13, line 2 for the injecting of the flexible tubing into the ground. The attention of the applicant is drawn also to col. 9, lines 8-11 of D2.

V-2 The subject-matter of claims 3-5, 9 and 10 is also not new, as in particular:

- cl. 3: see D2, col. 6, lines 40, 41;
- cl. 4: see D2, col. 2, lines 26-28;
- cl. 5: see D2, hammer portion 36;
- cl. 9, 10: see D2, col. 8, line 60- col 9, line 7.

V-3 The subject-matter of claims 2, 6-8 and 14 to 15 is routinely used in the field and therefore it does not involve an inventive step. See cited documents.

V-4 The subject-matter of claims 11 to 13 amounts to specific means for steering a

boring and compacting head which are neither disclosed nor made obvious by the cited art. The claims meet therefore the requirements of Art. 33(3) PCT.

- V-5 With reference to claim 16 D1 discloses a method of piercing an at least partially horizontal or inclined hole in a subsurface formation (fig. 1) with a steerable soil penetration system comprising a steerable penetration head (col. 3, line 20), wherein a thrust force is exerted to the steerable penetration head by an elongated flexible tubing (col. 2, lines 11, 12) and/or downhole propulsion means, thereby inducing the penetration head to pierce the hole in a desired direction, wherein the penetration head is configured to compact soil adjacent to the penetration head (col. 4, lines 19-30) substantially without the action of rotating cutters.

The subject-matter of claim 16 is therefore not new and the claim does not meet the corresponding requirement of Art. 33(2) PCT.

For completeness it is pointed out that the subject-matter of claim 16 is not new also in the light of D2, see section V-1 above.

- V-6 The subject-matter of claim 18 is not new in the light of D2, abstract.  
The subject-matter of claims 17 and 19 to 23 is new but it does not involve an inventive step. In particular:  
cl. 17: see D3, col. 4, 38-42;  
cl. 19: see D4, abstract;  
cl. 20: see D5, cl. 26;  
cl. 21, 22: features routinely used in the art;  
cl. 23: see D6, par. 0015.

- V-7 The following objections are also raised:

- a) The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).
- b) Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art is not correctly acknowledged in the description, as in particular neither the method according to D1 nor the one according to D2 will produce a large amount of drill cuttings (contrary to the statement in the description), see in particular D1, col 4, lines 22-30 and claim 14, and respectively D2, col. 6, lines 36-47.

REPLACED BY  
ART 34 ANDT

Rec'd CT/PTO 07 SEP 2004

10/506829

## STEERABLE SOIL PENETRATION SYSTEM

### BACKGROUND OF THE INVENTION

The invention relates to a steerable soil penetration system and method.

Such a system is known from US patent No. 5,163,520.

5 In the known system a steerable penetration head is pivotally connected to a string of tubulars that are interconnected by screw thread connectors and that are pushed in a substantially horizontal direction through a shallow subsurface soil layer by a hydraulic ram, which  
10 is mounted in a trench or pit. The ram pushes the tubing string and associated penetration head through the soil and when the last tubing section has been substantially inserted into the created hole the ram is pulled back whereupon a new tubing section is added to the tubular  
15 string which is then pushed into the hole, which sequence of adding a new tubing section to the string and inserting it into the hole is continued until the penetration head has reached its target.

20 Other steerable soil penetration systems are known from US patent Nos. 4,694,913; 5,070,948; 4,945,999; 4,306,626; 5,904,444; 5,878,825 and 4,981,181.

The aforementioned US patent 5,878,825 discloses a steerable penetration head, which is rotatably connected to a chain of short and rigid tubular elements that are  
25 interconnected by joints that are rotatable about a single axis. The chain of rigid tubular elements is pushed into the hole pierced by the steerable penetration head by an injector formed by a hydraulic piston assembly at the bottom of an injector pitch.

C L A I M S

1. A steerable soil penetration system, the system comprising:

- a steerable penetration head which is configured to penetrate the soil without the action of rotating cutters and which is connected to an elongate flexible tubing such that the orientation of the penetration head can be varied relative to the tubing; and
- means for injecting the elongate flexible tubing into the hole pierced by the penetration head and for inducing the penetration head to pierce the hole in a desired direction.

2. The steerable soil penetration system of claim 1, wherein the means for injecting the penetration head into the hole comprises a tubing injector assembly which pushes the tubing into the pierced hole thereby providing thrust to the penetration head, and wherein the tubing has an outer diameter which is more than 80% of the largest outer width of the steerable penetration head.

3. The steerable soil penetration system of claim 1, wherein the system is provided with a pump for pumping lubricating fluid through the interior of the tubing and an annular space between the tubing and the surrounding soil.

4. The steerable soil penetration system of claim 1, wherein the tubing is provided with conduits, electrical cables and/or optical fibres for the supply of power and/or for data communication and/or for measuring

14. The steerable soil penetration system of claim 1,  
wherein at least a substantial part of the elongate  
flexible tubing is configured to be circumferentially  
expanded after completion of the hole penetration  
process.

15. The steerable soil penetration system of claim 14,  
wherein the elongate flexible tubing is equipped with a  
staggered pattern of relatively weak wall segments that  
are configured to widen or open up during the  
circumferential expansion process, thereby reducing the  
forces required to circumferentially expand the tubing.

16. A method of piercing an at least partially horizontal  
or inclined hole in a subsurface formation with a  
steerable soil penetration system comprising a steerable  
penetration head, wherein a thrust force is exerted to  
the steerable penetration head by an elongate flexible  
tubing and/or downhole propulsion means, thereby inducing  
the penetration head to pierce the hole in a desired  
direction by compacting soil adjacent to the penetration  
head substantially without the action of rotating  
cutters.

17. The method of claim 16, wherein at least part of said  
thrust force is exerted on the penetration head by  
pushing the elongate flexible tubing into the pierced  
hole and the tubing has an outer diameter which is more  
than 80% of the largest outer width of the steerable  
penetration head and/or of the hole being pierced  
thereby.

18. The method of claim 16, wherein at least part of said  
thrust force is applied to the steerable penetration head  
by downhole propulsion means which comprises a downhole  
shock generator which hammers the penetration head